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Application of Rapid Filters for Cleaning Natural Water in the Conditions of the Kyrgyz Republic

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Abstract

This study evaluates the implementation and effectiveness of the rapid filtration method for enhancing natural water treatment in the Kyrgyz Republic, where outdated water treatment systems reduce both efficiency and reliability. The study examines the effectiveness of rapid filters in improving contaminant removal to meet modern water quality standards. Key aspects such as filtration efficiency, operational benefits, and coagulant incorporation, are assessed by comparing rapid filters with traditional slow sand filtration methods. The study employs empirical analysis, evaluations of existing systems, and case studies of filter-loading materials. Findings indicate that rapid filters significantly enhance water treatment efficiency, particularly when using advanced filter media that increase surface area. The integration of rapid filtration into water treatment facilities in Kyrgyzstan can provide significant environmental and economic benefits. This method offers a strategic framework for modernizing water treatment plants to improve public health and environmental sustainability.

Keywords

Load; Ecological efficiency; Economic efficiency; Quartz sand; Lightening; Innovative technology

Introduction

The issue of clean water in Kyrgyzstan encompasses socio-economic and environmental aspects. Effective purification requires water to be free of harmful substances, meeting quality and safety standards for long-term use. Currently, Kyrgyzstan's phased water treatment system includes sedimentation,

coagulation, filtration, and disinfection. Evaluating water quality indicators, treatment technologies, and relevant regulations highlights key principles for modernizing the country's water systems. These include comprehensive water quality assessment, optimizing existing technologies, and developing new solutions that meet health, environmental, and economic standards (Skarbøvik *et al*., 2010). Innovative monitoring and management, drawing from global best practices, and incorporating rapid filtration technology play a crucial role in advancing this modernization strategy.

Most modern researchers search for alternative technological opportunities in the water treatment sector that would facilitate progress towards ensuring high-quality drinking water. In particular, the attention of many modern researchers is focused on the methods of optimising natural water purification systems (Dzyba and Kyriienko, 2024). For example, Somma, Reverchon and Baldino (2021) investigated the specifics of improved surface water treatment technology. The achievements of researchers in the concept of modern methods of optimising water treatment systems indicate the prospects of using rapid filters. Several studies present the criteria for evaluating the effectiveness of water treatment measures aimed at improving the quality of drinking water (Maharramova and Maharramov, 2023). In particular, Yusupova *et al*. (2024) paid attention to the efficiency of water resources in the concept of their ecological and economic efficiency, substantiated the need for the implementation of water use technologies, and highlighted the main trends in the strategic development of the industry. Nuralieva (2022) argued that an effective water management system must necessarily take into consideration the requirements for environmental protection and careful management of natural resources.

It is a popular belief in the scientific community that the modernization of water treatment systems is primarily associated with the use of alternative filtering materials (Bondarev *et al*., 2023). The study by Cescon and Jiang (2020) substantiated this opinion by the advantages of using alternative media, especially glass media, including high filtration performance to remove residual particles and turbidity. The researchers summarized the existing standards of safe drinking water in the context of the driving force behind the development of new purification technologies and provided mathematical models for predicting filtration performance. Mautner (2020) paid special attention to new pollutants entering the natural aquatic environment, for which no rules and technological solutions have yet been established. Jiao *et al*. (2020) analysed the current problems of using filters, such as low adsorption rate, limited throughput, and the use of expensive materials and complex manufacturing methods, which prevent their widespread use to improve water quality.

Despite significant developments in the field of optimisation of water treatment systems in the modern scientific community, the issue of integrating the potential of modern water treatment technologies in Kyrgyzstan remains unresolved. The problem requires detailed analysis and the search for optimal solutions. The main purpose of the study was an extended analysis of the possibilities of using rapid filters to purify natural waters in the conditions of the Kyrgyz Republic with a focus on economic feasibility and environmental safety. To achieve this goal, the following tasks were set: to investigate the essence, advantages, and disadvantages of the rapid filter method; to consider the models and tools based on which its practical implementation is carried out; to determine the expediency of using this method in the field of water treatment in Kyrgyzstan,

including to substantiate management decisions aimed at the environmental sustainability of natural systems and economic benefits from the process.

Rapid filters enhance treatment efficiency, making water purification more reliable and cost-effective while supporting aquatic sustainability. These improvements will help ensure a safer, stable water supply, essential for public health and environmental resilience, offering long-term benefits for Kyrgyzstan's water treatment infrastructure.

Materials and Methods

Using both theoretical frameworks and real-world trials, this study assessed Kyrgyzstan's utilisation of fast filtration devices for natural water purification. The *Water Code of the Kyrgyz Republic (2005)*, and the *Law of the Kyrgyz Republic No. 34 "Technical Regulation 'On the Safety of Drinking Water'" (2011)* served as important regulatory foundations for this study. These offered crucial recommendations for evaluating filtration systems and their adherence to safety regulations.

To determine the relative effectiveness and usefulness of quick filters – including gravity-based non-pressure and pressurised systems – the study compared them to slow sand filters. Based on their operational parameters and frequency in water treatment facilities, particular models were chosen. To maximise particle aggregation and improve overall performance, coagulants like ferric chloride and aluminium sulphate were added to the filtration process. To ensure a representative simulation of municipal water treatment processes, the experimental setup incorporated pre-treatment activities such as flocculation, precipitation, and mixing.

Under carefully monitored circumstances, filters were tested on water samples with turbidity levels between 10 and 100 NTU. Typical urban and rural water supply circumstances were replicated using operational parameters such as pressures of 1 to 3 bar and flow rates between 5.5 and 15 m^3/h. Backwashing techniques included cleaning the filter media by reversing the water flow and adding compressed air. The sludge was gathered in a filthy wash water tank and disposed of.

By analysing turbidity reduction, pollutant removal, and water clarity, the filters' performance was evaluated. By examining maintenance frequency, filter lifespan, and coagulant effectiveness, operational efficiency was further assessed. Rapid filtration systems were the focus because of their high filtration rates and promise to assist economically and environmentally sound water treatment solutions.

As part of the technique, a schematic depiction of the experimental assembly was created. This is depicted in Figure 1, which shows how the water treatment processes run from source to output. This flowchart gives the study a clear visual framework by illuminating important parts such as the coagulation tank, quick filter, clean water tank, and backwash system.

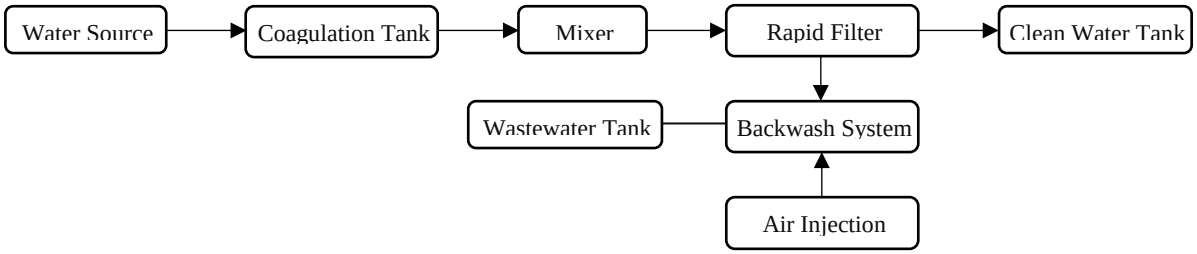

Figure 1. A flowchart of the water purification experiment assembly (Source: created by the authors)

The practical incorporation of fast filtration technologies into Kyrgyzstan's water treatment infrastructure is given top priority in this methodology. Despite being carried out on a trial size, the study's conclusions offer a basis for wider implementation, addressing both operational effectiveness and ecological sustainability. To ensure that the study's focus stayed on systems that do not modify the taste or odour of water, some limitations were purposefully included, such as the exclusion of activated carbon filters.

Results

Water Treatment Processes

In the process of choosing optimal water treatment technologies, priority is given to the implementation of an objective assessment of natural water supply sources. Within the conventional approach, water sources of natural origin that are used for water supply include surface and underground sources. The characteristics of natural water vary significantly due to numerous influencing factors, making the development of a single universal water treatment technology highly challenging. The individualization of solutions in the context of technology, facilities, and management measures allows for forming the most appropriate water treatment concept for specific treatment purposes. Regarding each source of water supply, a preliminary assessment of its qualitative and quantitative indicators of water, and the economic feasibility of its use, is necessary. The assessment should be implemented in the context of the long-term dynamics of natural water quality indicators and potential forecast changes (Jiao *et al*., 2020). The economic factor for each of the available resources is estimated within the framework of investment and operating costs.

The intensification of anthropogenic influence on surface catchments significantly affects changes in the hydrochemical regime of natural water bodies (Danilenko *et al*., 2021; Doroshkevich *et al*., 2017). Among the natural and anthropogenic factors that determine the qualitative characteristics of natural water, key elements include the features of the soil structure and surface cover, relief, climatic conditions, specifics of the geomorphological structure, river runoff, hydrology and hydrogeology, the level of anthropogenic influence and the general state of the ecosystem (Skliar *et al*., 2023). The possibility of using natural waters for various consumptive purposes is determined by their composition, concentration of undesirable substances and impurities, and their aggregative-kinetic stability. Water treatment processes are aimed at optimizing the organoleptic parameters of water (deodorisation, discolouration, clarification), conditioning the mineral composition (degreasing, softening, desalination, fluorination, desulphurisation), and

ensuring sanitary and epidemiological safety (chlorination, ozonation, radiation, and ultraviolet disinfection) (Nuralieva, 2022; Tikhonova *et al*., 2008).

Clarification and Coagulation

The main processes for improving natural water quality include clarification to remove suspended impurities using methods such as sedimentation in hydrocyclones, settling tanks, centrifugation, filtration, or flotation; coagulation to facilitate settling of suspended particles through adsorption of particles onto large aggregates formed by coagulants; decolourization of water by chlorination, pressure flotation, or filtration through granular activated carbon; degreasing to reduce iron salts by either non-reactive or reagent-based methods; fluoridation followed by filtration through rapid filters; aeration followed by rapid filtration; and disinfection via ozonation, potassium permanganate, or chlorination (Cescon and Jiang, 2020).

Disinfection and Conditioning

In the process of preparing natural water, purification is carried out mainly via classical technology, which involves discolouration and clarification through specialized settling tanks and clarifiers, and filtration through either fast or slow filters (Kravchenko and Tkachenko, 2024). The preparation culminates in disinfection, preventing the presence of pathogenic substances. A more advanced technological scheme for purifying natural water (Figure 2) involves mandatory reagent treatment, using a suspended sediment layer for discolouration and clarification, and high-efficiency rapid filters.

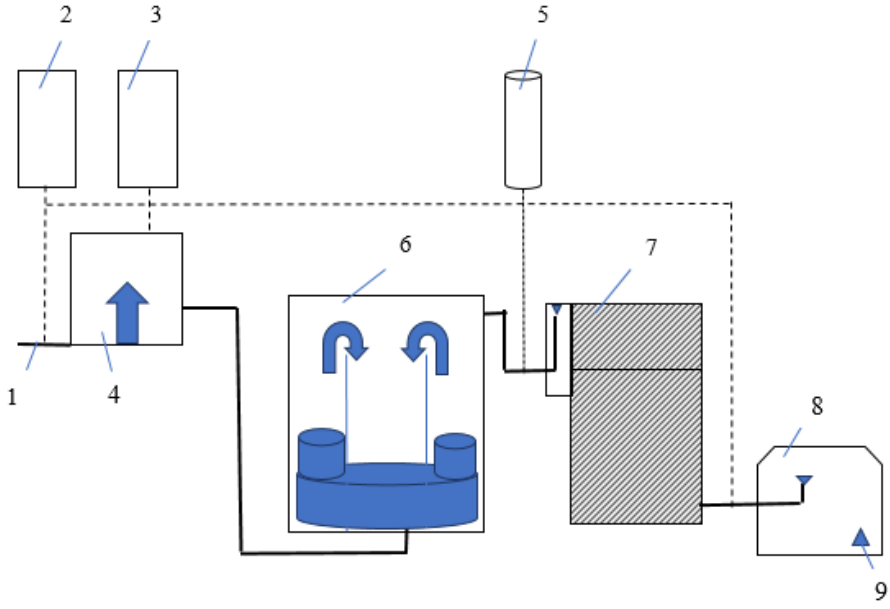

Figure 2: Advanced technological scheme of natural water purification with filters
(Source: created by the authors based on Alam *et al*., 2022; Alexyuk *et al*., 2021)
Note: 1 – source water supply, 2 – chlorination, 3 – coagulant tanks, 4 – vertical mixer, 5 – fluorination plant, 6 – clarifier with a layer of suspended sediment, 7 – rapid filter, 8 – clean water tank, 9 – purified water outlet.

The scheme proposed in figure 2 provides an ergonomic spatial solution. The filtering process itself is a means of differentiating heterogeneous systems and is conducted via special porous partitions of various physical types, which delay the solid phase while allowing the liquid phase to pass (Nuralieva, 2022). Based on the filter layer's characteristics, fabric filters (linen, nylon, cotton, cloth, and other types of fabric serve as a filter), mesh (the filtration process takes place through a mesh with small cells), alluvial (the filter layer is asbestos chips, wood flour, diatomite), and granular filters (expanded clay, marble quartz sand, anthracite, and other materials) are used (Mautner, 2020).

Filter Materials and Designs

Filters with granular loading are used to remove coarse particles; alluvial filters purify fine particles in low-grade waters; and fabric filters target fine particles. Granular filters are categorized as slow (0.2 m/h), rapid (5.5 to 15 m/h), or ultra-rapid (more than 25 m/h) (Wu *et al*., 2021). Filter loadings are usually placed on supporting layers of crushed stone or gravel, with layer thickness varying from 2 mm to 32 mm based on design and filtration conditions. The design features of the filter assume an open structure or pressure system, which involves the supply of water for purification from top to bottom, bottom to top, or both ways with variable or constant speed (Nascimbén Santos *et al*., 2020). Modern water purification solutions utilize rapid filtration for effective water clarification. Innovative rapid filters allow you to achieve a filtration process speed of up to 15 m/h. However, they can be both non-pressurised and pressurised. In the latter case, the process takes place under pressure created by a special pump. The height of the loading layer is determined based on the diameter of its grains: with grain sizes up to 1.25 mm, the optimal layer height is 700 mm; with sizes up to 1.6 – 1,200 mm; if the diameter is larger – approximately 2,000 mm (Wu *et al*., 2021).

Rapid filters with an area of less than 30 m^2 are equipped mainly with a side pocket, and more – with a central channel. The water that has been coagulated and pre-cleaned enters the side pocket, and then into the filter chamber. The height of the water layer located directly above the loading surface should reach 2 m or more (Nascimbén Santos *et al*., 2020). During the filtration process, the purified water enters first the filter layer, and then the supporting one. At the end, the filtered water enters the distribution system, then into the clean water tank, after which the water is ready to be discharged for intended use. The process of flushing the filter load occurs in the opposite direction: water enters the distribution system, after which it enters the filter layer, expanding it, and separating the load from impurities. Together with the washed dirt, the washing water is poured into the gutters, then into a special side pocket, after which it is sent to the drain. The gutters must be at a certain height, which allows them to avoid getting into them together with contamination of the particles of the load itself (Saravanan *et al*., 2021).

Filters are classified by design and pressure methods into non-pressure gravity filters and pressure filters. Non-pressure filters rely on water level differences, while pressure filters use pumps to create the necessary force. Filters can also be single-flow (top-down) or double-flow (bi-directional) (Gul, Hruza, and Yalcinkaya, 2021). Horizontal pressure filters, with filtration areas around 30 m^2, offer complex designs and high dirt capacity, while simpler two-layer filters are effective during phytoplankton blooms, using sand

and anthracite or, occasionally, activated carbon for de-chlorination (Lyubchik *et al.*, 2005; Saravanan *et al.*, 2021). A supporting layer of 0.5 m, usually of gravel or crushed stone, prevents fine material from leaching. High-resistance distribution systems prevent grain loss, and over 100 floating-loading filter designs now exist, including high dirt capacity and multi-tiered options (Dotto and McKay, 2020). Continuous or periodic filtration uses automated presses, cartridge filters, and drum vacuum filters to handle various suspensions with either vacuum or pressure mechanisms (Hasan, Muhammad and Ismail, 2020).

Economic and Practical Considerations

In modern technical water supply systems, it is often assumed that the water clarification process is implemented exclusively at the filtration stage, levelling the possibilities of coagulation, and purification in settling tanks and clarifiers (Khan, Zhu and Chen, 2024). In such cases, it is recommended to use coarse-grained filters with an increased filtration rate. Clarification of water exclusively at the filtration stage creates opportunities for the development of an innovative approach to the industrial water supply system without a second-lift pumping station, which significantly increases the economic efficiency of the process. Within the limits of such conceptual solutions, pressure filters are mainly used – steel cylindrical tanks with a given internal pressure, allowing water to be supplied to the consumer after the filters (Ang and Mohammad, 2020). A large number of such filters are required for a high-performance water treatment plant. It is considered advisable to install horizontal filters, which, with the same diameter, allow for a large filtration area.

Efficiency Enhancements in Filtration

The efficiency of rapid filters for natural water purification was determined by qualitative indicators of the composition of the dispersed phase and the dispersion medium, filtration technology, and applied methods of chemical water treatment. Optimisation of the structural, mechanical and physicochemical properties of the suspension is positioned as the basic priority task of improving the efficiency of the filters (Bondarev and Gheorghe, 2022; Mihai, Bondarev and Negoiu, 2013). Intensification of filtration efficiency at water treatment plants of the water pipeline is currently becoming possible by implementing solutions in the concept of new filter materials with high-loading porosity and a well-developed specific surface area of grains (Saravanan *et al*., 2021). In addition, the filtration quality is improved by applying active molecular groups to the surface of the grains, which allows artificial intensification of the level of their activity due to the increasing positive charge potential of the surface.

Innovative improvements in filtration involve developing multilayer or heterogeneous single-layer filters, enhancing water distribution uniformity and filter reliability while reducing costs and simplifying installation (Alam *et al.*, 2022). In Kyrgyzstan, physicochemical purification – including settling, coagulation, filtration, and chlorination – is commonly used to remove pollutants (Irgashev *et al.*, 2023; Ishenbayeva *et al.*, 2023). Enhanced coagulation using high-molecular flocculants improves clarity with minimal pressure loss (Karimovich, Sharipovich and

Abduxamidovich, 2023). Rapid filters show potential in modern systems, employing techniques to maximize dirt capacity, such as:

- filtering with decreasing grain size to trap sediment within the load;
- strengthening sediment density to reduce resistance and increase impurity capacity;
- using high-porosity materials like volcanic tuffs and expanded clay;
- adjusting filtration rates;
- applying pressure filtration (Crosson *et al*., 2021).

Filtering with descending grain sizes leverages ascending and multi-stage techniques, using coagulants and flocculants to compact sediment. Over time, rapid filters may lose granular layer thickness, requiring reconstruction to optimize performance. Improvements include standardizing grain uniformity, restoring filter load composition, using advanced media like expanded clay and volcanic slags, designing gravel-free drainage systems to prevent displacement, and enhancing filter flushing intensity, especially with water-air flushing techniques (Zubtsova and Skliar, 2023). These steps collectively enhance filtration efficiency and durability.

Rapid filters provide efficiency, reliability, environmental sustainability, and opportunities for innovation and optimization in response to natural variations in water quality and treatment objectives (Shuka *et al.*, 2011). Their disadvantages include higher operating costs, complex design, and the need for monitoring to ensure proper water treatment quality. When comparing fast and slow sand filters, neither filter affects water taste in the absence of activated carbon in the filter media. Slow filters use gravity to move water through the sand, while fast filters use pumps to create upward and downward flows of water. Sand filtration must be preceded by pre-treatment operations such as mixing, settling and flocculation, and the use of coagulants is recommended. Backwashing is accomplished by reversing the water flow and applying compressed air. In Kyrgyzstan, the implementation of these approaches can improve the efficiency of water treatment systems, optimize operation, improve filtration reliability and water quality, and provide significant economic benefits (Matkivskyi and Taras, 2024).

Discussion

Our findings indicate the prospects of rapid filters in enhancing natural water purification systems in Kyrgyzstan. Special attention should be paid to the variability of loading to reduce quantitative indicators of water pollutants while simultaneously increasing the level of ecological sustainability of ecosystems. In addition, innovative methods for operational management and monitoring of technological processes in water treatment have significant potential (Dzhedzhula, Yepifanova and Shevchuk, 2024). The monitoring system facilitates integrating new solutions in the field of rapid filters with maximum efficiency, considering data on the dynamics of natural water quality and purification efficiency. Most modern researchers, whose scientific interest is focused on water treatment issues in modern conditions of socio-economic development, confirm the adverse impact of relying solely on conventional methods of water use on the environment, given the intense negative dynamics of the quality of natural waters (Alexyuk *et al*., 2021). This situation emphasizes the scientific search for solutions in the context of the modernisation of water treatment systems.

For example, Parvulescu *et al.* (2022) argue that the modernisation of water treatment in the context of urban water supply systems involves a step-by-step transition from conventional solutions to high-tech ones, with the introduction of the principles of sustainable development. This opinion reflects the main scientific proposal of this study, in particular, regarding the need to ensure the environmental safety of natural water purification and filtration systems. The findings of Akhtar *et al.* (2021) suggest that the level of eco-modernisation in water treatment approaches serves as an indicator of the effectiveness of the practical use of research developments. However, researchers can argue about the feasibility of integrating high-tech solutions into existing water treatment systems in the context of developing countries, because outdated technical bases are not always ready for radical modernisation and require a phased, large-scale transformation.

Most contemporary researchers position the effectiveness of natural water purification technologies as the basis for maintaining a favourable local and regional sanitary and hygienic environment, public health, and development aligned with sustainability priorities (Golovko *et al.*, 2021). Researchers pay attention to the risks of secondary pollution of natural watercourses by water treatment plants themselves. In the context of the danger posed by water treatment systems for aquatic ecosystems, it is impossible to fully agree with the conclusions of researchers, since ensuring the accuracy of technological schemes and implementing preventive measures against uncontrolled ingress of pollutants from the filter into the aquatic environment as a result of improper flushing can help minimize the negative impact of direct purification processes (Mel'nyk *et al.*, 2023).

In continuation, the differentiated approach to optimization programs for water treatment systems proposed as a priority in the current study has received positive feedback in the work of contemporary researchers. For example, Rathi and Kumar (2021) are convinced that adsorption using rapid filters is a successful approach to removing pollution worldwide, as it involves low installation costs, high productivity, and simple design. The researchers developed a technology for removing pollutants using various adsorbents (nano adsorbents, hybrid adsorbents activated carbon, and improved biochar). The proposed concept corresponds to the premise of the current study in terms of the need to find new ways to improve the operation of rapid filters based on load variability. Nasrollahzadeh *et al.* (2021) and Morin-Crini *et al.* (2022) argue about the expediency of individualising natural water purification optimization programs to achieve maximum efficiency, and they cannot be objected to.

Zenina et *al.* (2024) underscore the importance of a robust monitoring system for enhancing the efficiency and sustainability of Kyrgyzstan's water projects, a perspective that supports this study's focus on practical integration. The implementation of rapid filters requires criteria that align with sustainability goals, echoing researchers' emphasis on monitoring as a means to address negative trends in water quality and predict future changes. Additionally, the hydrogeochemical analysis highlighted by Tleuova *et al.* (2023) provides a foundation for evaluating pollution sources and customizing treatment approaches. This localized perspective reinforces the viability of rapid filters in addressing Kyrgyzstan's unique environmental and economic needs, potentially creating a more effective, region-specific water treatment system that supports both environmental protection and public health objectives.

The insights from Kydyrbekova *et al.* (2022) into the dynamics of water resource innovations in emerging markets underscore the potential for rapid filters to enhance both environmental sustainability and economic performance in Kyrgyzstan. The correlation between industry innovations and the role of local expertise highlights how the integration of rapid filters can leverage local organizational culture and innovation-friendly environments to improve water management. While Mero *et al.* (2023) and Shahini *et al.* (2023) caution that societal attitudes can hinder technological adoption, the introduction of procedures emphasizing economic benefits may encourage greater public receptivity. This dual focus on technology and economic incentives aligns with strategies to foster effective water treatment improvements that are supported by both community engagement and sustainable practices (Ivanovs *et al*., 2018; Kusmambetov and Suleimenova, 2022).

In many studies, in particular, by Radelyuk *et al*. (2024) and Ernazarovna, Kuvatovich and Mamarajabovich (2021), barriers and prospects for the development of an effective water management system in developing countries are considered. In particular, while analysing the problems of preparing drinking water from surface water sources, the researchers highlight the possibility of effective use of the potential of rapid filters in modern natural water purification systems. It is impossible to fully agree with the researchers' conclusions regarding the versatility of ozonation technologies at the initial stage of water purification. The review paper by Kazakbayeva and Shaibek (2021) demonstrated the possibilities of rationalising water use systems. However, attention is focused on the successful international experience of rational water management, studying the structure of water resources management and considering the main economic instruments affecting the process of water resources management. They must be taken into consideration in the process of promising optimisation of the water treatment and water use system in Kyrgyzstan.

Assubayeva's (2023) insights highlight the importance of water treatment technologies that foster sustainable aquatic ecosystems, capable of mitigating pollution and adapting to increased anthropogenic stress. The emphasis on innovative technical solutions and substantial industry investment supports the integration of rapid filters, aligning to achieve environmentally safe water treatment. The concept of renewability, as discussed by Hartmann *et al.* (2024), reinforces the importance of regeneration within natural ecosystems, an approach that can enhance long-term sustainability without excessive financial demands. This perspective underscores the value of technological solutions like rapid filters in maintaining ecological balance and resource efficiency.

The results of numerous studies, in particular by Karimov *et al.* (2021), demonstrate the functionality of rapid filters, which, if innovative solutions are used in technological aspects, can significantly increase the efficiency of water purification. The researchers analysed the possibilities of using cheap local raw materials (sand) from Kyrgyz springs to load filters. It was proved that all technological schemes for purifying natural drinking water from surface sources using a fast non-pressure filter are more economically profitable than similar conventional schemes with filter loading, generally accepted in the post-Soviet space. Most researchers focus on the potential for the assimilation of conventional water treatment systems and new solutions in the field of filtration systems.

Conclusions

The findings of the study indicate the potential of water purification systems in enhancing the state of the aquatic ecosystems of the Kyrgyz Republic, the sanitary and hygienic situation and the level of public health. Technological modernisation of water treatment in Kyrgyzstan should be focused on the gradual replacement of obsolete methods with intensive ones based on the principles of environmental safety and economic efficiency. The priorities of sustainable development of aquatic ecosystems today are the competent strategic planning of innovative and technological development of the water industry, and a system of effective regeneration and preventive measures. Ensuring the high quality of drinking water, at the same time, is a prerequisite for the integration of technological capabilities into water treatment systems. In the context of innovations in general in Kyrgyzstan, it is expected that it is advisable to use the capabilities of rapid filters, which will provide prerequisites for solving the urgent problem of identifying reserves to ensure high-quality natural water treatment.

Analysis of the impact of modern water treatment measures on the dynamics of water quality indicates that rapid filters have significant potential in the context of improving the effectiveness of natural water treatment. Special attention in the research process is paid to the potential of loading variability within the dualistic concept of both reducing quantitative indicators of water pollutants and simultaneously increasing the level of ecological sustainability of ecosystems. Innovative capabilities of operational management and monitoring of technological processes in water treatment, considering the dynamics of natural water quality, will allow the implementation of new solutions in the field of rapid filters with maximum efficiency. A systematic approach to improving the quality of water treatment, considering the growing anthropogenic loads on water sources, and optimizing existing methods while developing new technical means of water purification based on the principles of sanitary and hygienic reliability, environmental friendliness and economic feasibility will optimise the situation in the field of water use of the Kyrgyz Republic.

The purpose of prospective scientific study in this area is the development and integration of innovative monitoring and forecasting systems for the state of aquatic ecosystems, and the integration of successful international experiences in water purification systems using rapid filters.

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Authors' Declarations and Essential Ethical Compliances

Authors' Contributions (in accordance with ICMJE criteria for authorship)

Contribution	*Author 1*	*Author 2*	*Author 3*	*Author 4*
Conceived and designed the research or analysis	Yes	No	Yes	No
Collected the data	No	Yes	Yes	Yes
Contributed to data analysis & interpretation	Yes	Yes	No	No
Wrote the article/paper	Yes	Yes	Yes	Yes
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